What is claimed is:

1. A method for imaging of the properties of a scattering target medium, comprising:

generating a first vector of measured data and a second vector of measured data, the first vector of measured data being indicative of energy emerging from a target medium, the second vector of measured data being indicative of energy emerging from a target medium, the emerging energy substantially originating from at least one source directing the energy into the target medium;

normalizing the first and second vectors of measured data; and

solving a modified perturbation formulation of the radiation transport inverse problem for a relative change between a known property of a reference medium and the corresponding unknown property of a target medium, wherein the modified perturbation equation relates the normalized measured data and a vector of reference data for the known reference medium to the relative change in the property, the vector of reference data being indicative of energy emerging from the known reference medium.

2. The method of claim 1 wherein the normalization of the first and second vectors of measured data comprises determining the difference between the first and second vectors of measured data relative to the second vector of measured data.

3. The method of claim 1 wherein the modified perturbation equation has the following form:

$$(\delta \mathbf{I}_r)_i = \left[\frac{I_i - (\mathbf{I}_0)_i}{(\mathbf{I}_0)_i}\right](\mathbf{I}_r)_i \text{; and}$$

$$\mathbf{W}_r \cdot \delta \mathbf{x} = \delta \mathbf{I}_r,$$

where δx is a vector of the relative changes between a known property of the reference medium and the corresponding unknown property of a target medium, for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous regions forming a representation of the target medium and reference medium, W'_r is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium, I_r is the vector of reference data indicative of energy emerging from the reference medium, I is the first vector of measured data and I_0 is the second vector of measured data.

4. The method of claim 1 wherein the normalization of the first and second sets of measured data comprise determining the natural logarithm of the quotient of the first set of measured data and the second set of measured data.

5. The method of claim 1 wherein the modified perturbation equation has the following form:

$$(\delta \mathbf{I}')_i = \ln \frac{I_i}{(\mathbf{I}_o)_i};$$

$$(\mathbf{W}'_r)_{ij} = \frac{(\mathbf{W}_r)_{ij}}{(\mathbf{I}_r)_i};$$

$$\delta \mathbf{I}' = \mathbf{W}'_r \delta \mathbf{x}$$

where δx is a vector of the relative changes between a known property of the reference medium and the corresponding unknown property of a target medium for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous, nonoverlapping regions forming a representation of the target medium and reference medium, W_r is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium, where I_r is the vector of reference data indicative of energy emerging from the reference medium, I is the first vector of measured data and I_0 is the second vector of measured data.

6. The method of claim 1 wherein the property is at least one of an absorption coefficient and a scattering coefficient.

7. The method of claim 1 wherein the first vector of measured data and second vector of measured data are obtained from one target.

8. The method of claim 1 wherein the first vector of measured data is obtained from a first target and the second vector of measured data is obtained from a second target.

9. The method of claim 1 wherein the first vector of measured data is obtained at a first instant in time and the second vector of measured data is obtained at a second instant in time.

10. The method of claim 1 wherein the first vector of measured data is obtained at a first instant in time and the second vector of measured data is a time averaged mean of a plurality of measurements.

11. A method of claim 1 further comprising generating an image representing the cross-sectional relative changes in the property.

12. A system for imaging of the properties of a scattering target medium, comprising:

means for generating a first vector of measured data and a second vector of measured data, the first vector of measured data being indicative of energy emerging from a target medium, the second vector of measured data being indicative of energy emerging from a target medium, the emerging energy substantially originating from at least one source directing the energy into the target medium;

means for normalizing the first and second vectors of measured data; and

means for solving a modified perturbation formulation of the radiation transport inverse problem for a relative change between a known property of a reference medium and the corresponding unknown property of a target medium, wherein the modified perturbation equation relates the normalized measured data and a vector of reference data for the known reference medium to the relative change in the property, the vector of reference data being indicative of energy emerging from the known reference medium.

13. The system of claim 12 wherein the normalization of the first and second vectors of measured data comprises determining the difference between the first and second vectors of measured data relative to the second vector of measured data.

14. The system of claim 12 wherein the modified perturbation equation has the following form:

$$(\delta \mathbf{I}_r)_i = \left[\frac{I_i - (\mathbf{I}_0)_i}{(\mathbf{I}_0)_i}\right](\mathbf{I}_r)_i \text{; and}$$

$$\mathbf{W}_r \cdot \delta \mathbf{x} = \delta \mathbf{I}_r,$$

where δx is a vector of the relative changes between a known property of the reference medium and the corresponding unknown property of a target medium, for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous regions forming a representation of the target medium and reference medium, W'_r is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium, I_r is the vector of reference data indicative of energy emerging from the reference medium, I is the first vector of measured data and I_0 is the second vector of measured data.

15. The system of claim 12 wherein the normalization of the first and second sets of measured data comprise determining the natural logarithm of the quotient of the first set of measured data and the second set of measured data.

16. The system of claim 12 wherein the modified perturbation equation has the following form:

$$(\delta \mathbf{I}')_i = \ln \frac{I_i}{(\mathbf{I}_o)_i};$$

$$(\mathbf{W}_r')_{ij} = \frac{(\mathbf{W}_r)_{ij}}{(\mathbf{I}_r)_i};$$

$$\delta \mathbf{I}' = \mathbf{W}_r' \delta \mathbf{x}$$

where δx is a vector of the relative changes between a known property of the reference medium and the corresponding unknown property of a target medium for corresponding volume elements of the reference medium and the target medium, the volume elements being an imaginary grid of contiguous, nonoverlapping regions forming a representation of the target medium and reference medium, W_r is a weight matrix describing the influence that each of a plurality of volume elements of the reference medium has on energy emerging at a point on the reference medium, where I_r is the vector of reference data indicative of energy emerging from the reference medium, I is the first vector of measured data and I_0 is the second vector of measured data.